Results: Thirty-four patients were treated in the selected time period, 15 male and 19 female, and 13 right limbs and 21 left limbs. Radiotherapy was delivered pre-operatively in 18 cases and post-operatively in 16 cases. In 20 cases, localisation was performed to the pelvis, 12 cases to the knee joint and 2 cases to the shaft of the femur. The mean population error in the vertical, longitudinal, and lateral directions was 0.3mm, 0.2mm and -0.3 mm respectively. Systematic and random errors for these directions were calculated to be 1.6(2.4) mm, 1.4(2.2) mm and 1.0(2.5) mm respectively. These data resulted in calculated margins in the vertical, longitudinal and lateral directions of 5.6mm, 5.1mm and 4.3mm respectively.

Conclusions: These data show that our customised immobilisation system and imaging protocol provide a set-up reproducibility covered by the margins typically used (5-7mm). Although margin reduction could be facilitated, there are limitations of this audit. Firstly, the limitations of the kV imaging length results in only one end of the limb being imaged and therefore the effect of rotation cannot be seen at the other end. Secondly, since direct visualisation of the soft tissue target is not possible with kV imaging, planning target volume (PTV) coverage is only assumed. The advent of extended length cone beam CT will enable direct visualisation of PTV, the entire extent of the femur, and other organs at risks e.g. external genitalia.

EP-1665

Do radiotherapy tattoos reliably guide patient set up for breast tumour bed treatment? - A review of current practice

S. Chauhan[1], J. Stratford[1], I. Patel[2], H. Lander[3], C. Anandadas[3], J. Loncaster[3]

[1]*The Christie NHS Foundation Trust, Wade Centre for Radiotherapy Related Research, Manchester, United Kingdom*

[2]*The Christie NHS Foundation Trust, Christie Medical Physics and Engineering, Manchester, United Kingdom*

[3]*The Christie NHS Foundation Trust, Clinical Oncology, Manchester, United Kingdom*

Purpose/Objective: The introduction of a national trial where the whole breast, partial breast and tumour bed are concurrently treated using photon radiotherapy and verified using daily online Cone Beam CT (CBCT) imaging, has enabled this institution to gather 3D set up data in regards to breast tumour bed coverage. The tumour bed Clinical Target Volume (CTV) is expanded by 0.5cm in 3-dimensions to create the tumour bed Planning Target Volume (PTV). Treatment will only be delivered when the tumour bed is within 0.2cm of the planned position.

Breast patients were immobilised with both arms above head using the Q-Qual™ board. During patient set up, alignment of the lateral and anterior radiotherapy tattoos was achieved. All planned isocentric shifts were executed to determine the L-R, S-I and the initial A-P treatment position. A further A-P adjustment may be required dependant on the planned concurrent tangential beam entry point in relation to the radiotherapy tattoos. This review aims to evaluate the reliability of using radiotherapy tattoos for breast patient set up in relation to breast tumour bed coverage for trial patients at this institution.

Materials and Methods: Imaging data for trial breast patients receiving 3D-CBCT guided radiotherapy, treated between January 2014 and October 2014, was retrospectively analysed within Elekta Synergy ™-version 4.5.

The frequency of set-up corrective action greater than 0.2cm in response to 3D-CBCT imaging and associated treatment margins were determined.

Results: Data for 135 treatment sessions of 9 patients was analysed. 85% of sessions required set-up correction greater than 0.2cm in at least one direction; 56% (76/135) of moves were required in the L-R direction, 46% (62/135) in the S-I direction and 54% (73/135) in the A-P direction (with an average magnitude shift of 0.32cm, 0.31cm and 0.34cm respectively).

The required CTV-PTV margin for the tumour bed, based on uncorrected and corrected data, is shown in table 1.

Table 1 - Required Breast Tumour Bed PTV margin, based on uncorrected and corrected data

Radiotherapy tattoo guided patient set-up –v- CBCT guided set up (Breast tumour bed)	Translational plane		
Radiotherapy Tattoo guided patient set up	L-R / cm	S-I / cm	A-P / cm
Random error	0.15	0.17	0.20
Systematic error	0.2	0.16	0.19
PTV margin - Van Herk margin recipe	**0.6**	**0.53**	**0.63**
CBCT guided patient set up			
Random error	0.04	0.05	0.05
Systematic error	0.01	0.02	0.01
PTV margin - Van Herk margin recipe	**0.05**	**0.08**	**0.07**

Conclusions: Treatment accuracy within 0.2cm in any translational plane will only be achieved in 15% of trial breast tumour bed treatments where set up is guided using radiotherapy tattoos alone. However, using radiotherapy tattoos in conjunction with 3D-CBCT image guidance will ensure accurate tumour bed coverage using the current 0.5cm CTV-PTV expansion of the breast tumour bed. The local practice of ensuring tumour bed coverage is within 0.2cm in any given translational plane prior to treatment delivery does imply that a CTV-PTV margin of less than 0.5cm could be applied for this trial. However, margin reduction should be applied with caution, as delineation and intra-fractional variation has not been measured.

EP-1666

Validation of a method for selecting patients for daily image and online evaluation in head and neck cancer treatments

N. Espinosa[1], A. Coral[1], M. Vargas[1], C. Diaz[1], J. Cabezali[1], F. Suriñach[1], E. Arroyo[1], V. Rosas[1]

[1]*Hospital de la Santa Creu i Sant Pau, Department of Radiation Oncology, Barcelona, Spain*

Purpose/Objective: Our center is using NAL3 plus weekly imaging as Image Guidance protocols for 3DCRT and IMRT techniques. However some of head and neck cancer (HNC) patients ended up with daily images. Our goal is to propose a method to identify HNC patients that should be included in a daily image on-line review protocol after the three first fractions.

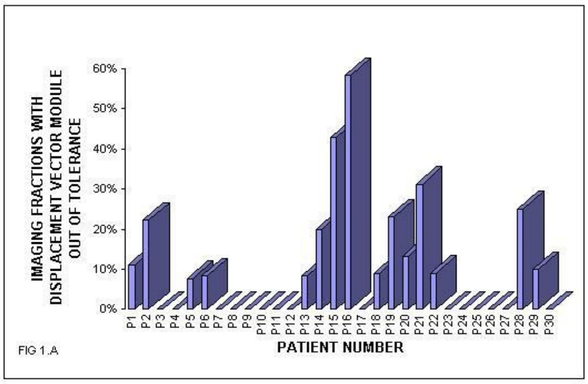
Materials and Methods: HNC patients are immobilized by customized thermoplastic masks. Patients are first positioned by matching lasers to three marks on the mask. Then, kV-MV orthogonal images are taken and compared on-line with DRRs from the simulation TC. The structures used for image registration are drawn on DRRs by the Radiation Oncologist. If the results of the on-line comparison are larger than the tolerance limits (±0.3cm in any direction) the position is corrected by table couch translations. Differences resulting from the on-line comparison for the first three sessions are recorded and used to calculate the systematic error. The systematic error correction will be implemented from the 4th session.

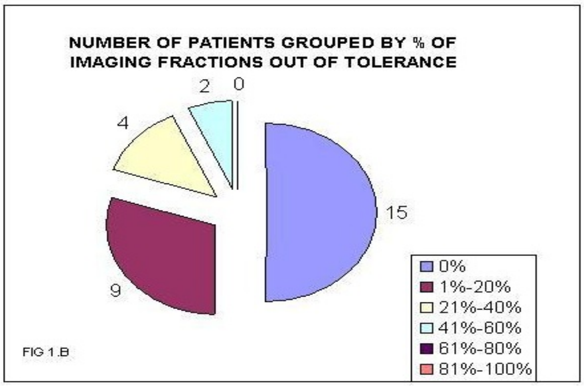
For this study, we calculated the residual set-up error of the first three sessions after correction for the systematic error. Patients were divided in two groups of 30 patients each; those having residuals lower (group A) and higher (group B) than the tolerance limits. For group A, weekly imaging sessions were planned. In case of errors higher than the tolerance limit on weekly images, table displacements were applied and images were repeated on the next day. For the group B, daily images were planned and table displacements were applied when differences exceeded tolerances.

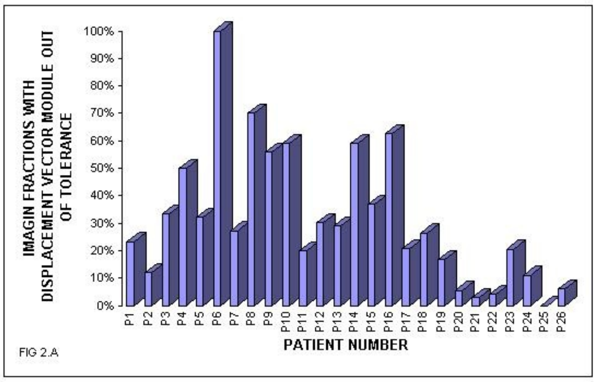
For both groups of patients we calculated the module of the three-dimensional displacement vector for each imaging session. A set-up difference was considered out of tolerance when the module value exceeded 0.52 cm. The percentage of fractions with imaging that were out of tolerance was calculated for each patient.

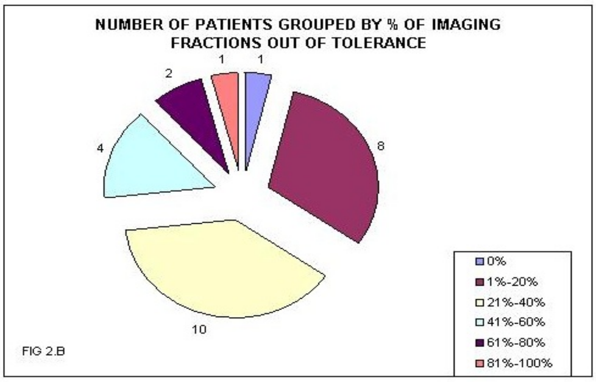
Results: Results for patients in group A are shown in figure 1. Most patients in group A did not need any set-up correction. Only for 6 patients more than 20% of the fractions needed set-up corrections. The fractions showing set-up difference larger than the tolerance limits were those close to the end of treatment.

Results for group B are shown in figure 2. For this group 18 out of 30 patients would need set-up corrections for more than the 20% of fractions.









Conclusions: The evaluation of residuals after NAL3 is a good method for selecting patients that will benefit from daily images and on-line evaluation. Not applying a daily imaging for that group of patients would result in more than 20% of fractions being delivered with a positioning error that would lead to a suboptimal irradiation of the CTV. For this group of patients either an on-line daily imaging strategy or re-planning with larger PTV margins would be recommended. The latter approach would result in larger doses to healthy tissue and nearby organs at risk.

EP-1667

Tracking of respiratory motion by using the gyroscope sensor for respiratory gated radiotherapy

<u>J. Sung</u>[1], W. Chung[2], M. Yoon[1], D. Kim[2]

[1]*Korea University, Bio-convergence Engineering, Seoul, Korea Republic of*

[2]*Kyung Hee University Hospital at Gangdong, Radiation Oncology, Seoul, Korea Republic of*

Purpose/Objective: The purpose of this study is to develop the respiratory monitoring system based on the gyroscope sensor and evaluate its possibility as the respiratory training system for respiratory gated radiotherapy.

Materials and Methods: We developed respiratory monitoring system based on the gyroscope sensor for respiratory gated radiotherapy. It is composed of 3 parts: gyroscope sensor, interface, and monitor. Gyroscope sensor is to sensor angular velocity of movement, interface is to connect gyroscope sensor and monitor through the ethernet or serial port, and monitor is to display signal from gyroscope sensor using the home-made software. To estimate the accuracy of gyroscope sensor, gyroscope sensor was placed on the moving phantom which was moved as the respiratory motion and detected its